

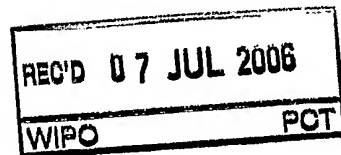
## PATENT COOPERATION TREATY


## PCT

## INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)



Applicant's or agent's file reference P18991WO		<b>FOR FURTHER ACTION</b>		See Form PCT/IPEA/416
International application No. PCT/EP2004/002754		International filing date (day/month/year) 17.03.2004		Priority date (day/month/year) 17.03.2004
International Patent Classification (IPC) or national classification and IPC INV. H04L12/46				
Applicant TELEFONAKTIEBOLAGET LM ERICSSON (PUBL) et al				
<p>1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of 6 sheets, including this cover sheet.</p> <p>3. This report is also accompanied by ANNEXES, comprising:</p> <p>a. <input checked="" type="checkbox"/> sent to the applicant and to the International Bureau) a total of 11 sheets, as follows:</p> <p><input checked="" type="checkbox"/> sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).</p> <p><input type="checkbox"/> sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.</p> <p>b. <input type="checkbox"/> (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or tables related thereto, in electronic form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).</p>				
<p>4. This report contains indications relating to the following items:</p> <p><input checked="" type="checkbox"/> Box No. I Basis of the report</p> <p><input type="checkbox"/> Box No. II Priority</p> <p><input type="checkbox"/> Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</p> <p><input type="checkbox"/> Box No. IV Lack of unity of invention</p> <p><input checked="" type="checkbox"/> Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</p> <p><input type="checkbox"/> Box No. VI Certain documents cited</p> <p><input type="checkbox"/> Box No. VII Certain defects in the international application</p> <p><input checked="" type="checkbox"/> Box No. VIII Certain observations on the international application</p>				
Date of submission of the demand  08.05.2006		Date of completion of this report  06.07.2006		
Name and mailing address of the international preliminary examining authority:  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465		Authorized officer  de la Peña Álvarez,  Telephone No. +49 89 2399-6587		



**INTERNATIONAL PRELIMINARY REPORT  
ON PATENTABILITY**

International application No.  
PCT/EP2004/002754

**Box No. I Basis of the report**

1. With regard to the **language**, this report is based on

- ☒ the international application in the language in which it was filed
- ☐ a translation of the international application into , which is the language of a translation furnished for the purposes of:
  - ☐ international search (under Rules 12.3(a) and 23.1(b))
  - ☐ publication of the international application (under Rule 12.4(a))
  - ☐ international preliminary examination (under Rules 55.2(a) and/or 55.3(a))

2. With regard to the **elements\*** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report):*

**Description, Pages**

2-4, 6-16	as originally filed
1, 5, 5A	received on 08.05.2006 with letter of 03.05.2006

**Claims, Numbers**

1-14	received on 08.05.2006 with letter of 03.05.2006
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**Drawings, Sheets**

1/4-4/4	as originally filed
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- ☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing

3. ☐ The amendments have resulted in the cancellation of:

- ☐ the description, pages
- ☐ the claims, Nos.
- ☐ the drawings, sheets/figs
- ☐ the sequence listing (*specify*):
- ☐ any table(s) related to sequence listing (*specify*):

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

- ☐ the description, pages
- ☐ the claims, Nos.
- ☐ the drawings, sheets/figs
- ☐ the sequence listing (*specify*):
- ☐ any table(s) related to sequence listing (*specify*):

\* *If item 4 applies, some or all of these sheets may be marked "superseded."*

# INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.  
PCT/EP2004/002754

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**Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

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1. Statement

Novelty (N)	Yes: Claims	1-14
	No: Claims	
Inventive step (IS)	Yes: Claims	
	No: Claims	1-14
Industrial applicability (IA)	Yes: Claims	1-14
	No: Claims	

2. Citations and explanations (Rule 70.7):

**see separate sheet**

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**Box No. VIII Certain observations on the international application**

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The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

**see separate sheet**

**Re Item V.**

The following documents are referred to in this communication:

- D1: US 2004/047320 A1 (EGLIN MATTHEW GEORGE) 11 March 2004
- D2: US 2003/142672 A1 (CHEN WEIPIN ET AL) 31 July 2003
- D3: US 2002/091795 A1 (YIP MICHAEL) 11 July 2002
- D4: US 2002/101870 A1 (CHASE CHRISTOPHER J ET AL) 1 August 2002
- D5: MELSEN S BLAKE ERICSSON T: "MAC Forced Forwarding: An ARP proxy method for ensuring traffic separation between hosts sharing an Ethernet access network" February 2004
- D6: WO 02/100062 A (NOKIA CORPORATION; EDNEY, JONATHAN; HAVERINEN, HENRY) 12 December 2002
- D7: US-B1-6 614 787 (JAIN VIPIN KUMAR ET AL) 2 September 2003

- 1 The subject-matter of claim 1 does not involve an inventive step (Art. 33(3) PCT).
- 1.1 D1, which is considered the closest prior art, discloses (the references in parentheses applying to this document), in terms of claim 1, a method of providing a service through a single broadband connection to an end user, said end user being connected to a core network through first and second independently tagged Virtual Local Area Network, VLAN, regions (par. 26, 28 and 29; fig. 1 and 5), wherein a VLAN Mapping Point device is implemented at a border between the first and second VLAN regions, wherein the first VLAN region is on a first side of the VLAN Mapping Point device toward the end user, and the second VLAN region is on a second side of the VLAN Mapping Point device toward the core network (par. 29; fig. 1 and 5); wherein,
  - upon receiving in the VLAN Mapping Point device, an upstream traffic packet from the first VLAN region, the VLAN Mapping Point device maps a VLAN tag for the first VLAN region to a VLAN tag for the second VLAN region and forwards the upstream traffic packet to the core network using the VLAN tag for the second VLAN region (par. 35 and 36; fig. 3A and 5); wherein,
  - upon receiving in the VLAN Mapping Point device, a downstream traffic packet from the second VLAN region, the VLAN Mapping Point device maps a VLAN tag for the second VLAN region to a VLAN tag for the first VLAN region and

forwards the downstream traffic packet to the end user using the VLAN tag for the first VLAN region (par. 35 and 36; fig. 3A and 5).

- 1.2 The subject-matter of claim 1 differs from D1 in that the mapping is done between a VLAN-per-user-per-service tag and a VLAN-per-service tag.
- 1.3 The differing feature solves the objective technical problem of how to separate traffic from different end users for the same service, so as to facilitate billing and traffic control, without involving higher protocol layers.
- 1.4 The objective technical problem is obvious because billing and traffic control are inherent to telecommunication networks, and because involving higher protocol layers would mean adding complexity to the end user equipment.
- 1.5 Faced with the objective technical problem, the skilled man would know that both using a single VLAN tag per service toward the core network to avoid unnecessary traffic duplication, and using a single VLAN tag per end user toward the end user to separate traffic from different users are well-known measures. Hence, in order to separate traffic from different end users for the same service, he would regard using a VLAN-per-user-per-service tag as an obvious measure.
- 2 The features of claim 1 mentioned in point 1.1 are also known from prior art documents D2 (par. 15), D3 (par. 28 and 29) or D4 (par. 19, 20, 22, 24, 26 and 30). The reasoning about the lack of inventive step of the subject-matter of claim 1 could have been carried out starting from D2, D3 or D4.
- 3 The same reasoning applies to claim 8, which covers the same subject-matter as claim 1 in terms of a VLAN Mapping Point device.
- 4 The additional features of the dependent claims do not add anything inventive because they are already known from the cited prior art (obtaining the VLAN tag from a table; extracting an aggregate VLAN tag from the multicast downstream packet; implementing an ARP proxy function).

**Re Item VIII.**

- 1 The application does not meet the requirements of Art. 6 PCT.
  - 1.1 Claim 1 is not clear regarding its category, because the characterising portion attempts to define the method in terms of apparatus features (e.g. "the first VLAN region is a last-mile network", "the VLAN tag for the second VLAN region is a VLAN-per-service tag").
  - 1.2 Claim 8 is not clear, because the characterising portion attempts to define the VLAN Mapping Point device in terms of features which do not belong to the VLAN Mapping Point device, casting doubt on the scope of protection sought (e.g. "the first interface connects to a first VLAN region comprising a last-mile network", "the VLAN tag for the second VLAN region is a VLAN-per-service tag").
  - 1.3 Claims 8, 9, 11-13 are not clear regarding their category, because a "mapping function" is not an apparatus feature. The expression "mapping function" could have been replaced, for example, by the expression "means for mapping".
  - 1.4 Claims 8-10 and 13 are not clear regarding their category, because they use method-type formulations (e.g. "the first interface connects to a first VLAN region"), which should have been replaced by apparatus-type formulations (e.g. "the first interface is adapted to connect to a first VLAN region").
  - 1.5 The claims are not grouped together (R. 6.4(c) PCT).

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## VLAN MAPPING FOR MULTI-SERVICE PROVISIONING

## BACKGROUND OF THE INVENTION

Technical Field of the Invention

5       The present invention relates generally to digital communication systems. More particularly, and not by way of limitation, the invention is directed to an apparatus and method for mapping Virtual Local Area Networks (VLANs) to end users and services when an end user accesses  
10 multiple services over a single broadband connection.

Description of Related Art

Ethernet is a packet-based transmission protocol that is primarily used in local area networks (LANs). Ethernet  
15 is the common name for the IEEE 802.3 industry standard. Data is transmitted in Ethernet frames, the structure of which is defined in the IEEE 802.3 standard. In addition, a VLAN ID field is specified in the IEEE802.1Q standard.

It is desirable for residential end users connected to  
20 broadband access networks to have access to multiple services. For example, if an end user has two PCs at home, he should be able to use one PC to surf the Internet while using the other PC to connect to his corporate network. The two PCs may have different IP address domains and  
25 different requirements to the network when it comes to parameters such as Quality of Service (QoS) and Security, but they are connected via the same broadband access network.

To achieve this goal, the broadband access network  
30 must separate traffic from different services in the

- 5 -

last-mile owners that own last-mile networks to the end users. The aggregation network may use the VLAN+MacFF Public Ethernet solution, but the last-mile networks may use standard off-the-shelf switches that support only the standard VLAN solution. In order to provide multiple services to end users in this case, the last-mile network owners would be required to change their devices to support the proprietary MacFF solution. This would add both investment and maintenance cost, and the last-mile network owners may not be willing to do that.

U.S. Published Patent Application No. 2004/047320A1 (Eglin) appears to disclose a WLAN system for providing clients with extended freedom of movement. The system automatically switches a mobile station from one access point to another. Wireless VLAN access points are each connected to an Ethernet aggregation switch, which is VLAN aware and matches client traffic from connected access points with access VLANs. However, there is no disclosure or suggestion in Eglin as to a method or device for providing an end user with multiple simultaneous services through a single broadband connection.

#### SUMMARY OF THE INVENTION

A remote access network scenario may be decomposed into a subscriber line part and an aggregation network part. The subscriber line, often referred to as "the last mile", is characterized by an individual physical connection to each end-user premise. The aggregation network performs aggregation and concentration of end-user traffic. The subscriber line and the aggregation network are separated by an access node, a layer-2 entity, which is referred to herein as a VLAN Mapping Point. Thus, the VLAN



- 5 A -

Mapping point constitutes the border between two independently tagged VLAN regions: the aggregation network and the individual subscriber lines (the last-mile network).

- 5 THE PRESENT INVENTION USES A MECHANISM CALLED VLAN MAPPING TOGETHER WITH THE VLAN+MACFF PUBLIC ETHERNET SOLUTION TO PROVIDE MULTIPLE SERVICES TO END USERS CONNECTED VIA LAST-MILE NETWORKS. VLAN MAPPING IS IMPLEMENTED IN THE VLAN MAPPING POINT. THE VLAN MAPPING POINT PROVIDES TWO PHYSICAL VLAN
- 10 (802.1Q) TRUNKS, ONE CONNECTED TO EACH VLAN REGION. THE VLAN MAPPING POINT

WHAT IS CLAIMED IS:

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1. A method of providing multiple simultaneous services through a single broadband connection to an end user (11), said end user being connected to a core network (12) through first and second independently tagged Virtual  
10 Local Area Network, VLAN, regions (14, 16),

wherein, a VLAN Mapping Point device (15) is implemented at a border between the first and second VLAN regions, wherein the first VLAN region is on a first side of the VLAN Mapping Point device toward the end user, and  
15 the second VLAN region is on a second side of the VLAN Mapping Point device toward the core network;

wherein, upon receiving in the VLAN Mapping Point device (15), an upstream traffic packet from the first VLAN<sup>17</sup> region (14), the VLAN Mapping Point device maps a VLAN tag for the first VLAN region to a VLAN tag for the second VLAN  
20 region (16) and forwards the upstream traffic packet to the core network (12) using the VLAN tag for the second VLAN region;

wherein, upon receiving in the VLAN Mapping Point  
25 device (15), a downstream traffic packet from the second VLAN region (16), the VLAN Mapping Point device maps a VLAN tag for the second VLAN region to a VLAN tag for the first VLAN region (14) and forwards the downstream traffic packet to the end user (11) using the VLAN tag for the first VLAN  
30 region;

wherein, the method is characterized by:

the first VLAN region is a last-mile network (14) connecting the end user (11) to the VLAN Mapping Point device (15);

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the second VLAN region is an aggregation network (16) connecting a Layer 2 termination point (18) to the VLAN Mapping Point device (15);

the VLAN tag for the first VLAN region is a VLAN-per-  
5 user-per-service tag; and

the VLAN tag for the second VLAN region is a VLAN-per-service tag.

2. The method of claim 1, wherein the step of  
10 mapping a VLAN tag for the first VLAN region to a VLAN tag for the second VLAN region includes the steps of:

obtaining the VLAN tag for the second VLAN region from a table in the VLAN Mapping Point device; and

replacing a VLAN ID in the upstream traffic packet  
15 with the VLAN tag for the second VLAN region. 18

3. The method of claim 2, wherein the step of mapping a VLAN tag for the second VLAN region to a VLAN tag for the first VLAN region includes the steps of:

20 obtaining the VLAN tag for the first VLAN region from a table in the VLAN Mapping Point device; and

replacing a VLAN ID in the downstream traffic packet with the VLAN tag for the first VLAN region.

25 4. The method of claim 3, wherein the step of obtaining the VLAN tag for the first VLAN region from a table in the VLAN Mapping Point device includes the steps of:

determining whether the downstream traffic packet is a  
30 unicast downstream traffic packet or a multicast downstream traffic packet;

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upon determining that the downstream traffic packet is a unicast downstream traffic packet, extracting a destination Media Access Control (MAC) address from the unicast downstream traffic packet; and

5 obtaining the VLAN tag for the first VLAN region from the table by matching the extracted MAC address to a corresponding VLAN tag for the first VLAN region.

5. The method of claim 3, wherein the step of  
10 obtaining the VLAN tag for the first VLAN region from a table in the VLAN Mapping Point device includes the steps of:

determining whether the downstream traffic packet is a unicast downstream traffic packet or a multicast downstream  
15 traffic packet; 19

upon determining that the downstream traffic packet is a unicast downstream traffic packet, extracting from the unicast downstream traffic packet, a destination Media Access Control (MAC) address and the VLAN tag for the  
20 second VLAN region; and

obtaining the VLAN tag for the first VLAN region from the table by matching the extracted MAC address and the VLAN tag for the second VLAN region to a corresponding VLAN tag for the first VLAN region.  
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6. The method of claim 4, wherein the step of obtaining the VLAN tag for the first VLAN region from a table in the VLAN Mapping Point device also includes the step of:

30 upon determining that the downstream traffic packet is a multicast downstream traffic packet, obtaining from the

table, a common VLAN tag for all end users in the first VLAN region.

7. The method of claim 4, wherein the step of  
5 obtaining the VLAN tag for the first VLAN region from a table in the VLAN Mapping Point device also includes the steps of:

upon determining that the downstream traffic packet is a multicast downstream traffic packet, extracting an  
10 aggregate VLAN tag from the multicast downstream traffic packet;

determining a number of entries in the table for which VLAN tags for the first VLAN region are associated with the extracted aggregate VLAN tag; and

15 duplicating the downstream traffic packet for each of<sup>20</sup> the entries in the table for which a VLAN tag for the first VLAN region is associated with the extracted aggregate VLAN tag;

wherein the VLAN Mapping Point device changes the VLAN  
20 ID in each of the duplicated downstream traffic packets to include a different one of the associated VLAN tags for the first VLAN region, and forwards the duplicated downstream traffic packets to end users using the associated VLAN tags for the first VLAN region.

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8. A Virtual Local Area Network, VLAN, Mapping Point device (15) implemented at a border between first and second independently tagged VLAN regions (14, 16), wherein the first VLAN region (14) is on a first side of the VLAN  
30 Mapping Point device toward an end user (11), and the second VLAN region (16) is on a second side of the VLAN Mapping Point device toward a core network (12),

wherein a first interface in the VLAN Mapping Point device receives upstream traffic packets from the first VLAN region (14) and sends downstream traffic packets to the first VLAN region;

5        wherein a second interface in the VLAN Mapping Point device receives downstream traffic packets from the second VLAN region (16) and sends upstream traffic packets to the second VLAN region; and

         a mapping function connected to the first and second  
10 interfaces which, upon receiving from the first interface an upstream traffic packet that includes a VLAN tag for the first VLAN region, maps the VLAN tag for the first VLAN region to a VLAN tag for the second VLAN region, and sends the mapped upstream traffic packet to the second interface,  
15 and, upon receiving from the second interface a downstream<sup>21</sup> traffic packet that includes a VLAN tag for the second VLAN region, maps the VLAN tag for the second VLAN region to a VLAN tag for the first VLAN region, and sends the mapped downstream traffic packet to the second interface;

20        wherein the VLAN Mapping Point device is characterized by:

         the first interface connects to a first VLAN region comprising a last-mile network (14) connecting the end user (11) to the VLAN Mapping Point device (15), wherein the  
25 VLAN tag for the first VLAN region is a VLAN-per-user-per-service tag; and

         the second interface connects to a second VLAN region comprising an aggregation network (16) connecting a Layer 2 termination point (18) to the VLAN Mapping Point device  
30 (15), wherein the VLAN tag for the second VLAN region is a VLAN-per-service tag.

9. The VLAN Mapping Point device of claim 8, wherein the mapping function includes:

a mapping table that matches VLAN tags for the first VLAN region to associated VLAN tags for the second VLAN region; and

means for changing a VLAN ID in received traffic packets, said means for changing a VLAN ID replacing the VLAN ID in upstream traffic packets with the VLAN tag for the second VLAN region.

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10. The VLAN Mapping Point device of claim 9, wherein the mapping table also matches VLAN tags for the second VLAN region to associated VLAN tags for the first VLAN region, and the means for changing a VLAN ID in a received traffic packet also replaces the VLAN ID of downstream traffic packets with the VLAN tag for the first VLAN region.

11. The VLAN Mapping Point device of claim 10, wherein the mapping function also includes:

means for determining whether a received downstream traffic packet is a unicast downstream traffic packet or a multicast downstream traffic packet;

means, responsive to determining that the downstream traffic packet is a unicast downstream traffic packet, for extracting a destination Media Access Control (MAC) address from the unicast downstream traffic packet; and

means for obtaining the VLAN tag for the first VLAN region from the mapping table by matching the extracted MAC address to a corresponding VLAN tag for the first VLAN region.

12. The VLAN Mapping Point device of claim 11, wherein the mapping function also includes:

means, responsive to determining that the downstream traffic packet is a multicast downstream traffic packet, for obtaining, from the mapping table, a common VLAN tag for all end users in the first VLAN region.

13. The VLAN Mapping Point device of claim 11, wherein the mapping function also includes:

10 means responsive to determining that the downstream traffic packet is a multicast downstream traffic packet, for extracting an aggregate VLAN tag from the multicast downstream traffic packet;

means for determining a number of entries in the table for which VLAN tags for the first VLAN region are associated with the extracted aggregate VLAN tag; and

means for duplicating the downstream traffic packet for each of the entries in the table for which a VLAN tag for the first VLAN region is associated with the extracted aggregate VLAN tag;

20 wherein the VLAN Mapping Point device replaces the VLAN ID in each of the duplicated downstream traffic packets with a different one of the associated VLAN tags for the first VLAN region, and forwards the duplicated downstream traffic packets to end users using the associated VLAN tags for the first VLAN region.

14. The method of claim 1, further comprising the step of separating, in the second VLAN region, traffic from multiple end users, by implementing an Address Resolution Protocol (ARP) proxy function in the VLAN Mapping Point device that ensures that upstream traffic packets from the



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first VLAN region are always sent to a designated access  
router.

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